

REMARKS

Claims 3-20 were pending in this case. Claims 3-8 have been cancelled without prejudice, and rewritten as new claims 21- 29. Withdrawn method claims 9-20 have been cancelled without prejudice and rewritten as new claims 30-40, to be consistent with new claims 21-29. No new matter has been added.

New independent claim 21 corresponds to cancelled claims 3, 6, and 7, and recites the cobalt and the titanium concentrations present, and the transition language "consisting of." New claims 22 and 23 are dependent on claim 21. New claim 22 recites the concentrations of the claimed elements present. New claim 23 corresponds to cancelled claim 8.

New claim 24 recites a narrower concentration range of the claimed elements present. New independent claim 25 corresponds to cancelled claims 3, 6, and 7, and recites the cobalt and the titanium concentration present, and the transition language "comprising." New claims 25-29 are dependent, either directly or indirectly, on independent claim 25. New claims 26 and 27 recite concentration ranges of the claimed elements present. New claims 27 and 28, correspond to cancelled claims 4 and 8, respectively.

Support for claims 21-29, is found in claims 1 and 2, as originally filed, and in the specification on pages 1, 3, 4, 5, and 6. No new matter has been added.

Favorable reconsideration is respectfully requested in view of the newly presented claims and following remarks.

I. At page 4 of the Official Action, Claims 3-7 have been rejected under 35 USC § 103(a) as being obvious over Senes et al. in view of Muenger et al.

The Examiner states, with regard to claims 3-5, that it would be obvious to one of ordinary skill in the art to incorporate the titanium oxide promoter of Muenger in the catalyst of Senes, to achieve an improved catalyst because Muenger teaches that titanium oxide is a known

and useful promoter. Regarding claims 6 and 7, the Examiner states that it would have been obvious to optimize the cobalt amount to achieve an effective catalyst, and that such optimization involves only routine experimentation. Likewise, with regard to claim 7, the Examiner states that it would have been obvious to predetermine the amount of titanium oxide needed, in order to sufficiently promote catalyst activity, and that such predetermination requires only routine experimentation. In view of the newly added claims, and remarks set forth below, this rejection is believed to be overcome.

Senes is directed to an ammonia synthesis catalyst consisting of iron oxide and cobalt oxide. Senes reports that this catalyst has high activity at low temperatures (200-400°C). Senes also states that the introduction of cobalt "permits the obtaining of excellent catalysts, even in the absence of promoters."

Further, Senes requires that the cobalt oxide be present in an amount of at least 5 weight percent expressed as cobalt. Senes states at col. 2, lines 27-50, that:

"It has been found the catalysts are reduced in a very rapid and very complete manner, and this is a very appreciable advantage...it has been discovered that the incorporation of a *considerable content* of a suitable metal [cobalt] in a conventional iron oxide catalyst ...imparts thereto a structure which is particularly favorable...The velocity of combination of the oxygen atoms of the iron with the reducer is extremely important, since it defines the specific surface, the distribution of final porosity, and the lacunary structure of the crystalline edifice. The addition of cobalt...during preparation of the catalyst permits the creation of a novel crystalline structure. *In the case of low contents [of cobalt], the cobalt influence is not very clearly marked, but it becomes very considerable from 5 percent on.* The preferred metal cobalt content is between 5 and 10 percent..."
(emphasis added)

Senes, at col. 3, lines 1-14, states that the mode of combining the iron oxide and the cobalt oxide, along with the cobalt content, are *decisive* in determining the efficacy of the catalyst

produced, such efficacy relative to ammonia synthesis. However, as recognized by the Examiner, Senes does not teach or suggest a catalyst including titanium oxide as required by the present claims.

Muenger is directed to a method for producing a synthesis gas from carbonaceous fuel. Muenger discloses that any suitable commercially available ammonia synthesis catalyst may be used to produce ammonia from the synthesis gas, but that single and doubly promoted catalysts are practical and give conversions of 8 to 40% of the gas after passage through a single converter. Muenger states that doubly promoted catalysts are made by melting a pure grade of iron oxide together with an acidic or amphoteric oxide, including for example titanium oxide, and with an alkaline oxide such as potassium oxide.

The present invention is directed to a catalyst for ammonia synthesis having improved activity. Present claims 21-29, all require cobalt present at a concentration of from 0.1 to 3.0 wt% and titanium present at a concentration of 0.1 to 1.0 wt%. It is the present inventors who have surprisingly discovered that the reaction rate at high ammonia concentration, increases 10% to 20%, when both titanium and cobalt are used as claimed, with conventional promoters. That is, the present inventors have surprisingly discovered that improved activity is achieved using a combination of a low concentration of cobalt, with titanium, both at high and low reaction temperatures. Please see page 3, "Brief Summary of the Invention" at paragraph 4.

Regarding claims 3-7, and as applied to new claims 21-29, it is also respectfully submitted that a case of prima facie obviousness has not been established. A case of prima facie obviousness under 35 U.S.C. §103, requires that the prior art as a whole, must suggest the desirability of making the claimed combination and provide a reasonable expectation of success. See *In re Dow Chemical Co.*, 837 F.2d 469, 5 USPQ2d 1529 (Fed. Cir.1988).

The *Dow* court further held that "In determining whether such a suggestion can fairly be gleaned from the prior art, the full field of the invention must be considered for the person of

ordinary skill is charged with knowledge of the entire body of technological literature, including that which might lead away from the claimed invention.” The court in *In re Gurley*, 27 F.3d 551, 31 USPQ2d 1130 (Fed. Cir.1994), held that “A prior art reference may be said to *teach away* when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant.” The court in *Busch & Lamb, Inc. v. Barnes-Hind/Hydro curve, Inc.*, 796 F.2d 443, 230 USPO 416 (Fed. Cir.1986), held that “A reference should be considered as a whole, and portions arguing against or teaching away from the claimed invention must be considered.”

Regarding combining references, the court in *In re Rouffet*, 149 F.2d 1350, 47 USPO.2d 1453 (Fed. Cir. 1998), held that “...this court requires the examiner to show a motivation to combine the references that create the case of obviousness. In other words, the examiner must show reasons that the skilled artisan, confronted with the same problems as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination in the manner claimed.” Lastly, the court in *Winner International Royalty Corp. v. Wang*, 202 F.3d 1340, 53 USPO.2d 1580 (Fed. Cir. 2000), held that if a prior art reference “did in fact teach away from [a second reference], then that finding alone can defeat [an] obviousness claim” based on combination of the two references.

In addition, when determining whether there is such a reason, suggestion or motivation to make a claimed combination, the full field of the invention must be taken into consideration, including the knowledge of one of ordinary skill in the art, such knowledge including technical literature. In this case, one of ordinary skill in the art would understand that titanium oxide is a promoter that improves thermal resistance but reduces catalytic activity. For example, please see *S. A. Abdukadyrova et al.*, Tr. Mosk. Khim.-Tekhnol. Inst. , No. 2,122-5 (1970), cited in the International Search Report as reference D 2. As noted in the International Preliminary

Examination Report, submitted on September 11, 2000, "The catalyst of the invention when used in the ammonia synthesis shows an increased activity at both low and high temperatures. This is convincingly demonstrated in the examples of the application. This effect could not be expected from the prior art, in particular because it was known from D 2 that titania reduces the activity in ammonia synthesis catalysts." Thus, the skilled artisan striving to produce a highly active catalyst, would have no motivation to investigate promoters like titanium oxide, which is known to result in reduced activity.

In the present case, the combination of Senes with Muenger is improper because there is no reason, suggestion or motivation to make the combination. Senes provides no motivation to one of ordinary skill, to look to art describing conventional promoters, for example, titanium oxide (Muenger), because Senes teaches that excellent catalysts are obtained even in the absence of conventional promoters, and because the skilled artisan understands that the use of titanium oxide as a promoter results in reduced activity. Likewise, one of ordinary skill in view of Muenger, would have no motivation to look to art directed to an improved catalyst, since Muenger is not concerned with improving catalysts.

In view thereof, it is submitted that the combination of Senes with Muenger, is improper.

Assuming *arguendo*, the combination of Senes with Muenger, is proper, it is also respectfully submitted that a case of *prima facie* obviousness has not been established.

Specifically, a skilled artisan confronted with the same problems as the inventor, i.e., producing an improved catalyst, and with no knowledge of the claimed invention, would have no motivation to select the cobalt of Senes and the titanium oxide of Muenger, let alone combine them as claimed. In fact, Senes *teaches away* from the claimed invention, because one of ordinary skill in the art in view of Senes would be *led away* from the path taken by Applicants, that is, the skilled artisan would be led away from further investigation of conventional promoters such as titanium oxide, because Senes teaches that excellent catalysts are obtained even in the absence of

conventional promoters, and because the skilled artisan understands that the use of titanium oxide as a promoter results in reduced activity.

Neither Senes nor Muenger, taken alone or together, suggest the desirability of modification of their respectively disclosed catalysts, to achieve the claimed catalyst requiring cobalt together with titanium oxide, let alone cobalt present at the claimed concentration of from 0.1 to 3.0 wt%. Thus, one of ordinary skill in the art, faced with the problem of producing a highly active catalyst, would have no reason to select the titanium oxide of Muenger to employ with the cobalt of Senes.

Further, assuming *arguendo* such motivation to select were present, the invention would not be achieved since neither of the references suggest cobalt present at a concentration of from 0.1 to 3.0 wt%, as required by the present claims. Again, Senes teaches away from the inclusion of cobalt at a concentration of less than 5.0 percent. Senes teaches that the amount of cobalt present is critical to achieve efficacy of the catalyst. More specifically, Senes *teach away* from any catalyst that does not contain sufficient amounts of cobalt in combination with titanium, where the amount of cobalt, and the mode of combination of cobalt and titanium, is critical.

Muenger does not cure the deficiencies of Senes, since Muenger also does not suggest the inclusion of cobalt or the inclusion of cobalt in the claimed amount. Neither of Senes nor Muenger, taken alone or together, suggest the desirability of modification of the respectively disclosed catalysts, to achieve the claimed catalyst requiring cobalt metal present at a concentration of from 0.1 to 3.0 wt%. Again, it is the present inventors who have surprisingly discovered that improved activity is achieved when using a low concentration of cobalt in combination with titanium. Such improved activity is achieved at both high and low reaction temperatures.

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In view of the arguments set forth above, and the newly presented claims, it is submitted that a proper case of *prima facie* obviousness has not been established, and further that nothing in the cited references, taken alone or together, render the claimed invention obvious within the meaning of 35 USC § 103 (a). Accordingly, the Examiner is respectfully requested to withdraw this rejection.

In view of the foregoing new claims and remarks, it is respectfully submitted that the application is in condition for allowance. Such allowance is solicited. Rejoinder of claims 30-40 is requested upon allowance of claims 21-29.

If the Examiner has any questions regarding this amendment, the application in general, or has any suggestions for placing the application in condition for allowance, the Examiner is requested to call the undersigned at the number listed below.

Respectfully submitted,

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